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Do High Interest Rates Defend Currencies during Speculative Attacks?

No — there is no systematic association between interest rates and the outcome of speculative attacks.

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Summary findings

Drawing on evidence from a large sample of speculative attacks in industrial and developing countries, Kraay argues that high interest rates do not defend currencies against speculative attacks. In fact, there is a striking lack of any systematic association between interest rates and the outcome of speculative attacks.

The lack of clear empirical evidence on the effects of high interest rates during speculative attacks mirrors the theoretical ambiguities on this issue.

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Do High Interest Rates Defend Currencies During Speculative Attacks?

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1. Introduction

According to conventional wisdom, currencies that come under speculative attack can be defended with high interest rates. By raising interest rates high enough, the conventional wisdom argues that the monetary authority can make it prohibitively costly for speculators to take short positions in the currency under attack. High interest rates are often also said to convey a positive signal regarding the commitment of the monetary authority to maintaining a fixed exchange rate. To the extent that this signal alters the expectations of foreign exchange market participants, high interest rates can serve to strengthen the domestic currency. A classic example in support of the conventional wisdom is the response to the attack on the Swedish krona in the summer of 1992, shown in the top panel of Figure 1. Between July and August, speculative pressures against the krona resulted in a loss of nearly one-quarter of the reserves of the Swedish central bank. To stem the outflow, the central bank's marginal lending rate was raised to an incredible 500 percent on September 17 and 18, and hovered in the vicinity of 50 percent for the next week. Reserve losses were promptly halted, and the krona's peg was maintained.

Recently, a contrarian view of the effects of high interest rates during speculative attacks has emerged, which calls into question both tenets of the conventional wisdom. First, it notes that interest rates have to be increased to very high annualized rates in order to entice even risk-neutral investors to hold local currency-denominated assets in the face of a small expected devaluation over a short horizon, and such extremely high interest rates are rarely observed in practice.[1] Second, this view notes that the signaling value of high interest rates is unclear. Although signals must be costly in order to be credible, often they impose costs that are too high for the monetary authority to take in stride. If market participants know that the monetary authority is concerned about the contractionary effects of high interest rates on domestic economic activity, they are unlikely to believe that rates will be kept high enough, and for long enough, to deter speculation. Worse, as the costs of high interest rates mount, the monetary authority's signal can become less credible over time, raising devaluation expectations. A vicious

[1] For example, a risk-neutral investor expecting only a 0.5 percent overnight depreciation would require an overnight annualized rate of return of 500 percent on domestic currency to compensate for the expected devaluation.

spiral can result, as expectations of a devaluation force higher interest rates, which in turn impose greater costs on the economy.[2] An example consistent with this contrarian view of the effects of high interest rates is Korea in the second half of 1997, shown in the lower panel of Figure 1. As the East Asian financial crisis spread from Thailand and Malaysia, speculative pressures against the Korean won intensified and the reserves of the Korean central bank fell from 35 billion to 25 billion US dollars between June and November. Although the overnight call rate was raised from around 12 percent in early November to over 30 percent by the end of December, the won fell by over 50 percent during this period.

In light of these theoretical ambiguities and conflicting anecdotes, this paper asks whether there is any systematic empirical evidence in support of the conventional wisdom regarding the effects of high interest rates during speculative attacks. To answer this question, I study the behaviour of interest rates around a large number of successful speculative attacks (i.e. attacks that end in a sharp nominal devaluations) and failed speculative attacks (i.e. attacks that did not end in a devaluation) in a sample of 75 developed and developing countries over the period 1960-1997. I examine whether interest rates rise during failed speculative attacks (i.e. whether raising interest rates is necessary to prevent a speculative attack from ending in a devaluation), and whether raising interest rates increases the probability that an attack fails (i.e. whether raising interest rates is sufficient to prevent a speculative attack from ending in a devaluation).

This empirical exercise faces three difficulties: measuring the policy response to a speculative attack, accounting for possible non-linearities in the effects of the policy response, and controlling for the endogeneity of the policy response. First, it is difficult to disentangle the monetary policy response to a given speculative attack from other sources of variation in observed market interest rates during the attack. For example, increases in market interest rates during a speculative attack might reflect both a tightening of domestic credit by the monetary authority, and also an increase in the

[2] Drazen and Masson (1994) develop a model in which signals become less credible over time. Bensaid and Jeanne (1997) formalize devaluation spirals. Radelet and Sachs (1998) and Furman and Stiglitz (1998) discuss other reasons why tighter monetary policy can weaken, rather than strengthen, the currency under attack.

devaluation expected by market participants. In order to obtain a direct measure of the monetary policy response to speculative pressures, I rely primarily on changes in interest rates under the control of the monetary authority (i.e. central bank discount rates) as a measure of policy. A drawback of this measure is that discount rates are only one of many instruments that the monetary authorities have at their disposal to resist speculative pressures. I therefore also check the robustness of the results using a variety of other noisier indicators of the stance of monetary policy.

Second, there may be important non-linearities in the effects of interest rates on speculative pressures, and ultimately on the outcome of the attack. For example, the credibility of the monetary authority's signal of its intent to defend the currency may depend on the economy's ability to withstand the contractionary effects of tight monetary policy, or on the quantity of reserves held by the monetary authority. In this case, simple correlations between measures of monetary policy and the outcome of speculative attacks may obscure any effects of policy present only in certain subsamples of speculative attacks. I take into account the possibility of episode-specific variation in the effects of monetary policy by splitting the sample along various dimensions, and by interacting measures of monetary policy with episode-specific characteristics.[3]

Third and perhaps most important, the policy decisions of the monetary authority are themselves endogenous, and are likely to depend on both episode-specific characteristics that determine speculative pressures, and on speculative pressures themselves. Consider an economy that is vulnerable to a speculative attack, perhaps because its real exchange rate is overvalued or its reserves are low relative to its short-term obligations. If attacks on vulnerable currencies are both more likely to succeed, and also are more likely to provoke a strong interest rate defense on the part of a "tough" monetary authority committed to maintaining the fixed exchange rate, one might expect to find large increases in interest rates during successful attacks, and conversely, small increases in interest rates during failed attacks. This endogeneity

[3] A second possible source of non-linearities is in the time dimension, if, for example, the signaling value of tight monetary policy becomes less credible over time. Since I will be relying on the relatively low-frequency monthly data available for this large sample of speculative attacks, there is unlikely to be enough time series variation in each episode to identify non-linearities over time in the effects of monetary policy.

problem may obscure the positive effects of high interest rates on investor confidence and the probability that an attack fails. It is also possible that the endogeneity bias exaggerates, rather than obscures, the conventional wisdom regarding effects of high interest rates. For example, if the monetary authority is "realistic" and determines that it is futile to try to defend a highly overvalued currency, but is willing to vigourously defend the currency when it believes fundamentals are sound, there may be a positive association between high interest rates and failed attacks driven by common fundamentals. In this paper, I present a simple model which formalizes this endogeneity problem, and motivates possible instruments for the monetary policy response. I then use these to control for the endogeneity of policy in a probit specification which expresses the probability that a speculative attack fails as a non-linear function of policy, episode-specific characteristics, and interactions between the two.

The empirical results are not very supportive of the conventional wisdom that high interest rates defend currencies during speculative attacks. I find no evidence that interest rates systematically increase during failed speculative attacks, nor that raising interest rates increases the probability that a speculative attack fails. I obtain the same results if I consider alternative measures of monetary policy, as well as possible non-linearities in the effects of monetary policy due to differences in a variety of episode-specific characteristics. The lack of evidence on the efficacy of monetary policy during speculative attacks persists even after I control for possible biases induced by the endogeneity of policy. Although there appears to be little evidence in support of the conventional wisdom, there is also little evidence in support of the contrarian view that raising interest rates weakens currencies under speculative attack. In fact, the main finding of this paper is the striking lack of any association whatsoever between changes in various measures of monetary policy and the outcome of speculative attacks.

This evidence contributes to a small but growing empirical literature on the role of monetary policy during speculative attacks.[4] Goldfajn and Gupta (1999) focus on the

[4] There is of course a large literature on the effectiveness of interventions in foreign exchange markets (see Edison (1993) for a survey). Various authors have also applied VAR methodologies to estimate the effects of monetary policy shocks on exchange rates. These papers, which focus on normal times as opposed to the periods of speculative pressures considered in this paper, find mixed results. Eichenbaum and Evans (1995) and Cushman and Zha (1997) find that positive innovations to monetary policy lead to depreciations of the domestic currency for the US and for Canada, respectively. In contrast, Sims (1992) and Grilli and Roubini (1995) find mixed evidence in the G5 and G7 economies, respectively, with positive monetary

role of interest rates in the aftermath of large devaluations that result in an undershooting of the real exchange rate. They ask whether high interest rates following a devaluation increase the likelihood that real exchange rate equilibrium is restored through a nominal appreciation rather than through higher inflation. They find that high interest rates are effective in this sense only in countries with strong banking sectors. Furman and Stiglitz (1998) examine daily data on interest rates and exchange rates in a sample of nine developing countries during the 1990s to identify episodes of sustained high interest rates, and then ask whether these were followed by an appreciation of the domestic currency. They find little evidence that this is the case. In contrast Dekle, Hsiao and Wang (1999a,b) study the relationship between interest rates and exchange rates using weekly data for Korea, Malaysia and Thailand during 1997 and 1998, and argue in favour of the conventional view. The main difficulty with all of these papers is that they simply document reduced-form (partial) correlations between interest rates and exchange rates. Without controlling for the endogeneity of the monetary policy response, it is difficult to infer anything regarding the effects of high interest rates from these papers. This paper makes a first attempt to take seriously the identification problem, drawing on a much larger sample of successful and failed speculative attacks.[5]

The remainder of this paper proceeds as follows. In Section 2, I describe the data and the methodology used to identify successful and failed speculative attacks. In Section 3, I present some descriptive results, which provide scant evidence of any association between changes in interest rates and the outcome of speculative attacks. In Section 4, I develop a simple model to illustrate the endogeneity problem, and I use this to motivate a set of probit regressions expressing the probability that speculative attacks fail as a non-linear function of policies and fundamentals. After instrumenting for the endogeneity of policy, I again find no evidence of a significant impact of high interest rates on the outcome of speculative attacks. Section 5 offers concluding remarks.

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shocks leading to appreciations in some countries and depreciations in others. Finally there is a large empirical literature documenting the properties of macroeconomic variables around speculative attacks (e.g. example Eichengreen, Rose and Wyplosz (1994,1995,1996)), which to date has not focused on the policy and non-policy determinants of successful and failed attacks.

[5] This concern with the endogeneity of monetary policy is of course not new, and is a recurring theme in the literature on the effects of monetary policy during normal times (as opposed to periods of speculative pressures). See for example the discussion in Bernanke and Mihov (1998) and Christiano, Eichenbaum and Evans (1998).

2. Identifying Speculative Attacks

I identify successful speculative attacks as large nominal depreciations preceded by relatively fixed nominal exchange rates. I begin with an unbalanced panel of monthly observations on nominal exchange rates (expressed in local currency units per US dollar) and non-gold reserves. The sample consists of 75 middle- and high-income countries with populations greater than 1 million, over the period January 1960 to April 1999. Details of the data can be found in the Appendix. I first identify all episodes in which the one-month depreciation rate (i.e. the increase in the nominal exchange rate) exceeds 10%, which is roughly two standard deviations above the mean monthly depreciation rate for the entire pooled sample of monthly observations. In order for these large depreciations to be meaningfully considered successful speculative attacks, it is necessary that the exchange rate be relatively fixed prior to the depreciation itself.[6] Accordingly, for each observation I construct an average over the previous twelve months of the absolute value of percentage changes in the nominal exchange rate. I then eliminate all large depreciation episodes for which this average exceeded 2.5%, or about one half of one standard deviation from the mean for the entire sample. In order to avoid double-counting prolonged crises in which the nominal exchange rate depreciates sharply for several months, I further eliminate successful attacks that were preceded by successful attacks in any of the prior twelve months. Finally, I discard all speculative attack episodes for which there is no data available on any of the variables I will use to measure the monetary policy response to the attack. This results in 105 usable successful speculative attack episodes.

I identify failed speculative attacks using two indicators of speculative pressures: sharp reserve losses, and sharp increases in nominal market interest rates. Specifically, I consider all episodes in which the monthly decline in non-gold reserves measured in US dollars (the increase in the nominal money market rate spread over the US Federal Funds rate) exceeds 20% (exceeds 5%), which is about two standard deviations above the mean change for the entire sample. In order to restrict attention to speculative

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6 I only require the exchange rate to be "relatively" fixed prior to the devaluation for two reasons. First, this enables me to identify the abandonment of narrow target zone exchange rates regimes as well as of fully fixed exchange rate regimes. Second, this allows me to identify currencies that are pegged against currencies other than the US dollar whose value relative to the US dollar does not fluctuate much (e.g. the German mark).

pressures against relatively fixed exchange rates, I eliminate all those episodes for which the same moving average of absolute values of changes in the nominal exchange rate as before was greater than 2.5%. Next, to avoid double-counting successful attacks, I exclude all episodes in which the change in the nominal exchange rate in the same month or any of the three following months was greater than 10%. I define these episodes as failed speculative attacks and, as before, I eliminate all failed attacks that are preceded by a failed attack in any of the twelve previous months, and those episodes for which indicators of the monetary policy response are not available. This results in 203 instances of failed speculative attacks.

Relying on reserve losses and increases in market interest rate spreads to identify failed speculative attacks is problematic, because these indicators potentially confound speculative pressures and the policy response to these pressures. For example published data on reserve losses does not permit me to distinguish between transactions of the monetary authorities to accommodate the increased speculative demand for their reserves, and direct sales of reserves by the monetary authority in order to support the currency. Similarly, increases in observed nominal interest rate differentials may reflect both increases in market participants' devaluation expectations as well as policy interventions in the money market, as noted in the introduction. However, to the extent that these considerations are important, the results will be biased towards finding that tightening monetary policy makes speculative attacks more likely to fail, simply because the definition of failed attacks in part reflects the presence of tight monetary policy. It is interesting to note that despite this obvious source of bias in favour of the conventional wisdom, I find little evidence of this view.

Table 1 lists the full sample of 308 episodes, sorted by success and failure, and by year. The sample includes a number of familiar episodes, as documented in Table 2. The recent spate of currency crises in East Asia in 1997 are all represented as successful speculative attacks, with the exception of Malaysia where the largest monthly depreciation of the ringgit in August 1997 (6.6 percent) was not large enough to qualify as a successful attack according to my definition. Table 2 also lists several speculative attacks associated with the turmoil in the ERM in 1992, and compares the dating of these attacks with that of Eichengreen, Rose and Wyplosz (1994). My criterion identifies several of well-known failed attacks during this period, including those on the

Danish kroner, French franc, Irish punt and the Spanish peseta, as well as the successful attacks on the British pound, the Swedish krona and the Finnish markkaa in the fall of 1992.[7] In most cases, the dating of events corresponds fairly closely to that of Eichengreen, Rose and Wyplosz (1994). The only large discrepancy is in the case of France, where they identify a speculative attack in September 1992 which I do not. This is because France's reserve losses of 8 percent in that month are not large enough according to my definition, while its much larger reserve losses in the fall of 1993 are.

Table 1 nevertheless also includes a number of more questionable episodes. Upon closer inspection, many of the episodes occur in country-period observations characterized by underdeveloped financial markets and/or restrictions on capital movements of various sorts. It is unlikely that the dynamics of speculative attacks in such distorted environments will be comparable with those occurring in countries with relatively developed financial markets and free capital mobility. In order to ensure that the results are not tainted by these questionable episodes, I also define a subsample of events where domestic credit to the private sector as a share of GDP (a summary indicator of financial development) averages more than 20% in the five years prior to the attack, and the black market premium on foreign exchange (a summary indicator of de facto currency convertibility) averages less than 10% in the five years prior to the attack. I refer to this subsample as the financially-developed subsample, and the countries included in it are indicated with asterisks in Table 1.

In Figure 2, I provide a graphical overview of successful and failed speculative attacks, plotting the evolution of the nominal exchange rate and reserves during "typical" attacks. To construct this figure, I compute the median growth rate in the exchange rate and reserves over all successful and failed attacks for every month in a two-year window centered on the date of the crisis, and then cumulate these median growth rates on a base of 100 one year prior to the crisis. By construction, successful attacks are marked by sharp nominal depreciations preceded by 12 months of very stable exchange rates. In fact, the median change in the nominal exchange rate prior to these episodes is zero. Reserves decline steadily over the entire period leading up to the collapse of the

[7] The initial attack on the Swedish krona in the summer of 1992 mentioned in the introduction does not qualify as an unsuccessful attack according to my definition since it was followed by a depreciation within three months.

exchange rate, indicating that speculative pressures emerge in advance of the collapse in the exchange rate itself, and reserves recover fairly quickly afterwards. Failed attacks are also by construction preceded by very stable nominal exchange rates, and feature sharp reserve losses in the month of the attack. As with successful attacks, reserves recover quickly following failed attacks.

The main question of interest is whether raising interest rates -- or more generally, tightening monetary policy -- prevents speculative attacks from ending in a devaluation of the currency. To address this question, I require measures of the stance of monetary policy around the speculative attack episodes identified above. I primarily rely on the real central bank discount rate (the nominal discount rate deflated by contemporaneous annualized monthly inflation) as a measure of the policy instrument most directly under the control of the monetary authority.[8] To the extent that the monetary authority uses this instrument during a given episode, this variable provides a good measure of the policy response to the speculative attack. However, as noted in the introduction, the monetary authorities in these many speculative attack episodes have a wide variety of instruments at their disposal. Attempting to identify the mix of instruments actually employed during each of the 308 episodes in the sample, and hence the appropriate episode-specific measure of the stance of monetary policy, would be ambitious to say the least.[9] I instead use two other measures as crude "outcome" indicators of the stance of monetary policy to check the robustness of the results: real domestic credit growth, and the reserves of deposit money banks held in the central bank. To the extent that the monetary authorities tighten monetary policy using other measures (e.g. open market operations, raising reserve requirements, etc.), this will be reflected in a reduction in real domestic credit and/or increases in bank reserves.[10]

[8] An unfortunate drawback of this measure is that central bank discount rates are reported by the IMF on an end-of-period basis only, so that intra-monthly fluctuations in this variable are ignored. Also, there is of course considerable debate over how to proxy for expected inflation when constructing real interest rates. The results presented here do not change substantially if I deflate using either past or future inflation rates, or if I simply consider changes in nominal discount rates.

[9] Even for the United States which has been the subject of decades of intensive research, there is no clear consensus on how precisely to measure the stance of monetary policy. See for example the discussion in Bernanke and Mihov (1998). See also Borio (1997) for a description of the bewildering array of instruments available in a set of developed countries.

[10] An obvious objection to the domestic credit growth measure is that it does not distinguish between shifts in the supply and shifts in demand for domestic credit. To alleviate this concern I have also defined tight

For each speculative attack episode, it is necessary to determine whether these measures of monetary policy tightened or not, relative to a suitable benchmark. For failed attacks, I consider the increase in real discount rates, the decrease in real domestic credit growth, and the increase in bank reserves in the month of the attack relative to the month prior to the attack. That is, I ask whether tightening monetary policy in response to a sudden reserve outflow serves to arrest further reserve losses and maintain the value of the currency. Given that speculative pressures appear in advance of the actual devaluation during successful attacks, I consider the change in each measure of monetary policy in the month prior to the attack relative to the previous month. That is, I ask whether tightening monetary policy in response to mounting speculative pressures serves to prevent attacks from succeeding. I do not include the month of the attack itself, so as not to capture any post-devaluation policy responses which may be quite different from those undertaken in defense of the currency prior to the devaluation.[11]

(loose) monetary policy as periods where both domestic credit growth fell (increased) and the discount rate increased (fell), with substantially similar results. A similar objection holds for the bank reserves measure.

[11] The effectiveness of monetary policy in the aftermath of devaluations is studied by Goldfajn and Gupta (1999).

3. Descriptive Results

In this section I present some simple descriptive statistics on the incidence and mean value of changes in the stance of monetary policy around successful and failed speculative attacks. The simplest possible graphical overview of the evidence is in Figure 3, which reports the frequency distribution of changes in real discount rates during successful and failed speculative attacks. The striking feature of this graph is that there is no apparent difference in the direction or magnitude of changes in discount rates during successful and failed speculative attacks. More formally, Table 3 uses contingency tables to summarize the changes in monetary policy during successful and failed speculative attacks. The three panels of Table 3 correspond to the three different measures of tighter monetary policy: increases in real discount rates, decreases in real domestic credit growth, and increases in bank reserves as a share of domestic credit. Each panel reports a contingency table, with the columns corresponding to successful and failed attacks, and the rows corresponding to whether monetary policy tightened or eased. Based on these tables, I report several statistics of interest. I first report the conditional probability that monetary policy tightens given that a speculative attack fails. If the conventional wisdom is correct and tightening monetary policy is a necessary condition to prevent speculative attacks from ending in a devaluation, one would expect this probability to be near one. In fact, it ranges from 0.33 to 0.57, depending on the measure of policy. In each case, the upper bound of a 95% confidence interval extends to no more than 0.65. In fact, for the first two measures of policy, the 95% confidence interval includes 0.5, so that it is not even possible to reject the null hypothesis that tighter and looser monetary policy during failed attacks are equally likely. This casts doubt on the notion that tightening monetary policy is necessary to ensure that speculative attacks fail.

I also report the conditional probability that a speculative attack fails given that monetary policy tightens. If the conventional wisdom is correct and tightening monetary policy is a sufficient condition for speculative attacks to fail, one would expect this probability also to approach one. In this sample, the estimated probability ranges from 0.60 to 0.72, with a 95% confidence interval extending to at most 0.80. This calls into question the idea that raising discount rates is sufficient to ensure that speculative attacks fail.

More formally, I also report the p-value for a chi-squared test of independence between changes in monetary policy and the success or failure of speculative attacks. For the first two measures, it is not possible to reject the null hypothesis of independence at conventional significance levels, suggesting that there is no relationship whatsoever between changes in the stance of monetary policy and the success or failure of speculative attacks. For the third measure, the null is (barely) rejected at the 95% significance level, but this does not constitute evidence in favour of the conventional view. To see this, note that the probability that an attack fails conditional on tightened monetary policy is 0.60, while the unconditional probability that an attack fails is 177/263=0.67 – in other words, speculative attacks are significantly *less* likely to fail when monetary policy is tighter than in the sample as a whole. The rejection of the null of independence tells us that this difference in probabilities is (barely) statistically significant.

In Table 4, I repeat the analysis, but restricting the sample to the financially-developed subsample described in the previous section. One might expect that any evidence on the efficacy of a high interest rate defense would be more apparent in this smaller set of observations. However, the results in Table 4 show that this is not the case. Although the conditional probabilities (of tighter monetary policy conditional on failure, and of failure conditional on tighter monetary policy) are generally a little higher in this sample, they are still far from one, and in no case can I reject the null hypothesis that changes in the stance of monetary policy and the outcome of speculative attacks are independent.

These results have been subjected to a wide variety of robustness checks that are not reported for brevity. These include: (1) restricting the sample of events to those for which all measures of monetary policy are available, (2) using a three-month instead of a one-month window over which to measure changes in the various indicators of monetary policy around the speculative attack, (3) varying the timing of changes in monetary policy relative to the date of the attack, and (4) defining tightened monetary policy as episodes where both real discount rates increased and real domestic credit growth fell. The main conclusion that the stance of monetary policy and the outcome of the speculative attack are independent is robust to all of these variants.

While Tables 3 and 4 provide a concise summary of the available evidence, they discard potentially useful information by treating changes in policy as binary events, i.e. interest rates, domestic credit growth or bank reserves increase or decrease only. I relax this restriction in Tables 5 and 6, which present two sets of statistics for the full sample of events and the financially-developed subsample, respectively. In the first three columns of both tables, I compute the mean change in each measure of monetary policy during successful and failed speculative attacks and test the null hypothesis that they are equal. This may be thought of as a weaker version of the tests of necessity in Tables 3 and 4, in the sense that a rejection of this null hypothesis constitutes evidence that tightening monetary policy is necessary to prevent speculative attacks from succeeding.[12] In the next two columns, I estimate the marginal impact of the change in each measure of monetary policy on the probability that a speculative attack fails, estimated from a probit regression including a constant term. I report the estimated marginal effect, and the t-statistic corresponding to the null hypothesis that the underlying coefficient on the policy measure is zero. This may be thought of as a weaker version of the earlier tests of sufficiency, in the sense that a positive impact suggests that tightening monetary policy raises the probability that an attack fails. In the final column I report the number of observations included in each test. The three panels of each table again correspond to the three measures of changes in the stance of monetary policy.[13]

A further drawback of the previous results is that they do not allow for the possibility that the effects of monetary policy may depend on fundamentals which vary across speculative attack episodes. In order to take these possible non-linearities into account, the rows of Table 5 report results for various subsamples corresponding to "good" values of such fundamentals. I first distinguish further between financially

[12] A stronger test would also require the mean tightening in monetary policy to be positive during failed attacks and negative during successful attacks.

[13] Unlike the data description in the previous tables, these summary statistics are not robust to extreme outliers in the measures of monetary policy. I therefore drop a small number of episodes occurring during periods of very high inflation where measured changes in real discount rates and real domestic credit growth are greater than 100 percent in absolute value.

developed and less-developed episodes by restricting the sample to the OECD, and to the 1980s and 1990s. Following the suggestion of Goldfajn and Gupta (1999) that interest rate defenses are only successful when the banking system is strong, I restrict the sample to those episodes that were not preceded by a banking crisis in any of the previous five years in the rows labelled "No Banking Crisis". Since one might expect that tightening monetary policy will only be effective if the exchange rate is not too overvalued, I construct a crude indicator of real exchange rate overvaluation as the trend growth rate of the real CPI-weighted exchange rate versus the US in the previous twelve months. In the rows labelled "No Real Overvaluation", I restrict the sample to those episodes where this growth rate is below the median for the entire sample. To capture the notion that a given defense may be more credible if the monetary authority can back up its commitment to a fixed exchange rate with a large stock of foreign currency reserves, I also divide the sample in half according to non-gold reserves relative to imports, and consider only the high-reserves subsample in the rows labelled "High Reserves". I also proxy for the overall weakness of the country's external payments position using the average over the previous twelve months of that country's borrowing from the International Monetary Fund, expressed as a share of its quota in the organization. In the rows labelled "Low Quota Drawings", I consider only those episodes where the country has no obligations to the IMF according to this measure. Finally, I consider the argument that it is easier to defend against a speculative attack during a booming economy than during a recession, presumably because the domestic economy is better able to withstand any of the adverse effects of high interest rates during the high point in the business cycle. I measure this as the deviation of real per capita GDP growth in a country from its average in the five preceding years, and then I divide countries in two at the median value of this deviation and consider only the booming economies in the rows labelled "High Point in Cycle".

The results in Tables 5 and 6 are not very supportive of the conventional view that tightening monetary policy lowers the probability that a speculative attack ends in a devaluation of the currency. In the vast majority of cases, the mean change in monetary policy is not significantly different during failed and successful attacks, and changes in the stance of monetary policy are not statistically significant predictors of the outcome of the speculative attack. Only in five cases are the estimated effects statistically significant at the 95% level, notably in the OECD subsample. However, when one considers that there are 96 separate hypothesis tests in Tables 5 and 6, I should expect around five rejections at the 95% significance level even if the stance of monetary policy and the outcome of speculative attacks were independent. Moreover, even the few significant results in the OECD subsample are to a large extent driven by a handful of successful attacks in Greece, Turkey and Portugal.

At first glance, the descriptive evidence presented in this section is hardly consistent with the view that tightening monetary policy is effective during speculative attack episodes. At the same time, it is also hardly consistent with the alternative view that tighter monetary policy has the perverse effect of weakening the currency under attack. Rather, this descriptive evidence suggests a striking absence of any systematic relationship between the stance of monetary policy and the outcome of speculative attacks.

4. The Endogeneity of Policy

Although useful as data description, the evidence in the previous section can provide only limited information about the effects of policy during speculative attacks. Since policy is itself likely to respond endogenously to the same fundamentals that drive speculation, and also to the strength of speculative pressures themselves, it is difficult to infer any structural relationship from the correlations of the previous section. In this section, I present a simple model which formalizes this issue and illustrates its ambiguous implications for the evidence of the previous section.[14] I then empirically address the endogeneity problem by estimating an instrumental variables probit model that expresses the probability that a given speculative attack ends in a devaluation as a non-linear function of fundamentals and measures of monetary policy, treating monetary policy as endogenous. After controlling for endogeneity of policy in this way, I still find no evidence that raising interest rates either lowers or raises the probability that a speculative attack ends in a devaluation of the currency.

A Simple Model

I consider a one-period model of a small open economy that fixes its exchange rate and comes under speculative attack. The economy is populated by a continuum of identical atomistic speculators of mass one, and a monetary authority. The monetary authority sets the domestic interest rate, i, at the beginning of the period, and at the end of the period decides whether or not to devalue the currency by an exogenously-given and known amount, ε. Speculators attack the currency by shorting it, i.e. by taking out loans in local currency at the interest rate set by the monetary authority at the beginning of the period, selling the proceeds to the monetary authority in exchange for US dollars at the beginning-of-period exchange rate, and then unwinding their positions at the end-of-period exchange rate.[15] Speculators determine their demand, S, for the reserves of

[14] See Drazen (1999), Lahiri and Vegh (1997, 1999) and Lall (1997) for other models which focus specifically on the role of interest rates as a defense during speculative attacks.

[15] In practice, shorting the domestic currency during speculative attacks is generally done using forward contracts, rather than domestic currency loans. However, the substance of the analysis is not changed by this complication. See Goldstein et. al. (1993), Garber and Svensson (1995), and Lall (1997) for details.

the monetary authority, R, by maximizing their profits net of borrowing costs, which I assume for convenience to be quadratic in the volume of speculation:

$$(1) \qquad \max_{<S>} \pi \cdot \varepsilon \cdot S - \frac{i \cdot S^2}{2}$$

where π denotes the representative speculator's perception of the probability that the currency will be devalued.[16] Solving this optimization problem and aggregating over all speculators results in a speculative demand for local currency $S(\pi, i) = \frac{\pi \cdot \varepsilon}{i}$.

The monetary authority decides whether or not to devalue the currency by weighing the costs and benefits of maintaining a fixed exchange rate. There are two costs to fixing: the monetary authority must spend a fraction $\frac{S(\pi,i)}{R}$ of its reserves to defend the exchange rate, and in order to maintain a desired level of reserves, it may need to set domestic interest rates higher than it would otherwise do in the absence of speculative pressures.[17] These costs are summarized in the following loss function of the monetary authority:

$$(2) \qquad L(\pi, i, \theta^*) = \frac{S(\pi, i)}{R} + \theta^* \cdot i$$

where for simplicity I have assumed that the monetary authority's disutility of raising interest rates is linear in the interest rate, with θ^* measuring the strength of its aversion to high domestic interest rates. The parameter θ^* is not known to speculators, who

[16] This convenient formulation of speculative behaviour is used by Drazen (1999). In the absence of such adjustment costs, risk-neutral speculators will take infinite short (long) positions in the currency under attack if the expected return to shorting is positive (negative). At the cost of complicating the algebra, one can also motivate a continuous speculative demand for loans by assuming that speculators are risk averse.

[17] I follow the conventional (implicit) assumption that the monetary authority dislikes reserve losses and devalues when these losses are excessive. However, it is natural to ask why this should be the case. One might also imagine that the monetary authority does not value reserves per se, but rather dislikes the capital losses it suffers following a devaluation when it restores its target level of reserves by purchasing them at the depreciated exchange rate. In this case larger reserve losses make devaluations more costly. Moreover, raising interest rates may have the perverse effect of raising the rationally-expected probability of a devaluation by making devaluations less costly to the monetary authority.

share a common belief that it is equal to θ. Let β denote the benefits of maintaining the fixed exchange rate regime. These benefits are also not known to speculators, who correctly perceive β to be uniformly distributed on the unit interval. Speculators do know that if the costs of maintaining a fixed exchange rate exceed the benefits, the monetary authority will devalue the currency to $1+\varepsilon$.

Speculators rationally form their beliefs regarding the probability that the monetary authority will devalue, given their perceptions of the "type" of the monetary authority, θ, and given the interest rate set by the monetary authority. In particular, speculators understand that $\pi = \Pr ob[L(\pi, i, \theta) > \beta]$, so that the rationally-perceived devaluation probability is:[18]

(3) $$\pi = \frac{\theta \cdot R \cdot i^2}{R \cdot i - \varepsilon}$$

I plot this probability as a function of the interest rate as a bold line in the top panel of Figure 4. At low levels of the interest rate, the perceived devaluation probability is decreasing in i. Over this range, speculation against the currency is intense, and the marginal benefit of raising interest rates (in terms of reducing reserve losses S) outweighs the perceived marginal cost to the domestic economy (as measured by the parameter θ). As a result, raising interest rates lowers the monetary authority's disutility of maintaining the fixed exchange rate, making a devaluation is less likely. In contrast, when interest rates are high, the marginal benefit of further increases in interest rates is smaller than the marginal cost to the domestic economy. Over this range, increases in the interest rate raise the disutility of the fixed exchange rate regime, and so raise the probability that the currency will be devalued.

[18] To simplify this calculation, I assume that $L(\pi, i, \theta) < 1$, so that $\Pr ob[L(\pi, i, \theta) > \beta] = L(\pi, i, \theta)$. It is straightforward to verify that this holds in equilibrium provided that the following parameter restriction is satisfied: $\frac{\varepsilon}{R} \cdot \sqrt{\theta \cdot \theta^*} \left(1 + \sqrt{\frac{\theta}{\theta^*}}\right)^2 < 1$. This restriction will hold provided that the devaluation rate ε is small enough and/or the amount of reserves R is large enough, which together ensure that the speculative demand for reserves is never too large.

The question of interest in this paper is the slope of $\pi(i)$, i.e. whether raising interest rates raises or lowers the probability that a speculative attack ends in a devaluation of the currency. However, estimating $\pi(i)$ using the data on speculative attack episodes described in the previous sections is complicated by two factors. First, for a given interest rate, the slope of $\pi(i)$ will depend on episode-specific characteristics. This nonlinearity is illustrated in the lower panel of Figure 4, which considers two speculative attack episodes that are alike in every respect, except that in the second the level of reserves is higher than in the first. Not surprisingly, the probability of a devaluation is everywhere lower in the second episode than in the first, since the monetary authority has more reserves at its disposal to defend the exchange rate. More important, at the same level of the interest rate (indicated by the vertical line), a small increase in interest rates in the first episode will lower the probability of a devaluation, while in the second episode it raises the probability of a devaluation.

The second difficulty is that the monetary authority's choice of interest rates is endogenous, and depends on the strength of speculative pressures against the currency. In order to illustrate this endogeneity within the confines of a very simple model, I assume that the monetary authority sets interest rates to minimize the costs of maintaining a fixed exchange rate. In particular, I assume that the monetary authority chooses i to minimize Equation (2), taking into account the dependence of $\pi(i)$ as given by Equation (3). The optimal interest rate chosen by the monetary authority is:

$$(4) \qquad i^* = \frac{\varepsilon}{R} \cdot \left(1 + \sqrt{\frac{\theta}{\theta^*}}\right)$$

and has a very natural interpretation. Other things equal, the higher is the devaluation rate ε or the lower are reserves R, the greater is the volume of speculation and the higher is the interest rate set by the monetary authority to deter this speculation. The greater is the monetary authority's aversion to high interest rates (the higher is θ^*), the lower is the optimal interest rate. Finally, the more speculators think the monetary authority dislikes high interest rates (the higher is θ), the higher the monetary authority needs to raise interest rates to reduce speculation.[19]

The important point is of course that the interest rate chosen by the monetary authority in Equation (4) depends on the same fundamentals as speculators' perceived probability of devaluation in Equation (3). In Figure 5, I illustrate how this endogeneity problem can either obscure or accentuate the effects of tighter monetary policy during speculative attacks. In the top panel, I again consider two episodes that are alike in every respect, except that in the latter the reserves of the monetary authority are higher than in the former. At the equilibrium in the first episode at A, $\pi(i)$ is decreasing in i, so that a small increase in interest rates has the conventional effect of lowering the perceived probability of a devaluation. In the high reserves case, the speculators' rationally-perceived devaluation probabilities are lower than before (shown as a downwards shift in $\pi(i)$), while the monetary authority reacts to these devaluation perceptions with a lower interest rate since it has a larger "cushion" of reserves. In this episode, the equilibrium is at B with a lower interest rate and a lower devaluation probability. Simply comparing these two episodes, one might easily be led to the mistaken conclusion that raising interest rates raises the probability of a devaluation, while precisely the converse is true (since both A and B fall on the downward-sloping portion of $\pi(i)$).

Similarly, the endogeneity problem may also lead to the conclusion that raising interest rates has the conventional effect of lowering the probability of a devaluation when in fact the opposite is true. I illustrate this possibility in the bottom panel of Figure 5. I again consider two identical episodes, which now differ only in the monetary authority's distaste for interest rates (θ^*) and speculators' beliefs regarding this parameter (θ). The dashed lines correspond to an episode where both θ^* and θ are lower than in the episode shown in solid lines. Not surprisingly, the monetary authority sets a higher interest rate, and since speculators believe that the monetary authority is "tough", the devaluation probability is lower for every interest rate i (shown as a

[19] I assume that the monetary authority knows speculators' perceptions regarding its type, i.e. the monetary authority knows θ. The main point of the model regarding the endogeneity of policy is unaffected if I instead assume that the monetary authority does not know θ but instead takes speculators' perceived devaluation probabilities as given when minimizing Equation (2).

downwards shift in $\pi(i)$). Comparing the equilibria A (with a high devaluation probability and a low interest rate) and B (with a low devaluation probability and a high interest rate), one might easily conclude that raising interest rates lowers the probability of a devaluation when the converse is true (since both A and B fall on the upward-sloping portion of $\pi(i)$).

This discussion illustrates how the endogeneity of policy can bias the estimated effects of policy in unknown directions. To the extent that the fundamentals that drive both speculative pressures and the policy response are not fully observable, partial correlations between policy and the outcome of speculative attacks will not correctly identify the effects of policy. To achieve identification, I require an exogenous source of variation in the interest rate set by the monetary authority that can be used as an instrument for policy. In this stylized model, the monetary authority's private information about its "type" (θ^*) plays this role, since changes in θ^* shift the monetary authority's reaction function without shifting speculators' rationally-perceived devaluation probabilities. More generally, any private information of the monetary authority which influences its choice of interest rates can in principle serve to identify the effects of interest rates on speculators' beliefs that an attack will end in the devaluation of the currency.

Empirical Specification

I now turn to the empirical specification motivated by this simple model. The objective is to estimate the impact of monetary policy on probability that a speculative attack fails. Although this probability is not observable, I do observe a binary indicator of whether a speculative attack fails or not. I can therefore estimate the marginal effects of policy on probability that an attack fails using a probit model, with this indicator as the dependent variable. The first implication of the theory is that this probability will be a non-linear function of fundamentals and the monetary policy response. Although the simple model discussed above is too stylized to take the exact functional form implied by Equation (3) literally, it does suggest that the explanatory variables in the probit equation should include not only measures of policy and fundamentals, but also interactions between the two. Accordingly, I consider the following non-linear probit specification:

$$y_j^* = \beta_0 + \beta_1 \cdot i_j + \beta_2' f_j + \beta_3' f_j \cdot i_j + u_j$$

(5)

$$y_j = \begin{cases} 1, \text{ if } y_j^* > 0 \\ 0, \text{ if } y_j^* \leq 0 \end{cases}$$

where y_j^* is an unobserved latent variable; y_j is an indicator variable taking the value 1 if speculative attack j ends in a devaluation; i_j is a measure of the stance of monetary policy; f_j is a vector of episode-specific fundamentals; and u_j is a normally-distributed disturbance term. I consider the same three measures of the stance of monetary policy (i_j) as in the previous section: increases in real discount rates, decreases in domestic credit growth, and increases in the reserves of the banking system, and five of the measures of fundamentals (f_j) discussed in the previous section: the presence of banking crises, the extent of real overvaluation, the adequacy of reserves, indebtedness to the IMF, and the point in the business cycle prior to the speculative attack.

The second implication of the theory is that i_j is endogenous and reacts to the same fundamentals that drive speculative pressures. To the extent that the observed fundamentals included in f_j do not capture all of these factors, the error term in Equation (5) will be correlated with policy. It is therefore necessary to instrument for both i_j and $f_j \cdot i_j$ in the above regression. The theory indicates that variables that are the private information of the monetary authority and influence its choice of monetary policy are candidate instruments. I rely on two instruments, both of which exploit informational asymmetries that are likely to exist between speculators and the monetary authorities. The first is the change in reserves (expressed in months of imports) in the month of the attack. Since in most countries the monetary authority publishes data on its reserves only with a lag, it will have information on the extent of aggregate speculative pressures reflected in reserve losses in advance of market participants who do not have timely access to this data. To the extent that the monetary authority bases its policy response on its observed reserve losses, this instrument will be correlated with policy. To the extent that these reserve losses are unknown to speculators, they will affect speculative pressures only through their effects on policy, and hence this measure is a valid instrument.

The second instrument is the ex post available information on the country's borrowing from the International Monetary Fund. If a country comes under speculative attack, it may seek resources from the IMF for temporary balance of payments support. To the extent that the IMF places conditions on the stance of monetary policy prior to agreeing to such support, changes in observed IMF borrowing will be correlated with the indicators of monetary policy around the speculative attack episode in question. To the extent that speculators have imperfect information as to the substance of the country's negotiations with the IMF, the IMF's influence over monetary policy will be known to the monetary authority, but not to speculators. I therefore proxy for the presence of IMF involvement by the change in a country's borrowing from the IMF in the three months following the speculative attack relative to the three months prior to the attack, and use this variable as an instrument for policy.

Obviously these instruments are imperfect. First, they may not be truly exogenous. There may be unobserved episode-specific characteristics which both raise the probability that an attack fails and also accelerate reserve losses or trigger IMF involvement. Second, despite caricatures to the contrary, the involvement of the IMF may not be significantly correlated with the subsequent stance of monetary policy. The first objection is easily addressed if the instruments pass tests of overidentifying restrictions. The second objection concerns the strength of the instruments. As is well known (Nelson and Startz (1990), Staiger and Stock (1997)), if the instruments are only weakly correlated with the endogenous variables, two-stage least squares coefficient estimates will be biased towards the probability limits of their uninstrumented counterparts in finite samples. That is, instrumenting with weak instruments will not correct the problem of endogeneity. This caveat should be kept in mind, since in many cases the explanatory power of the instruments is not as large as I would like.

I estimate Equation (5) using Amemiya's (1978) generalized least squares estimator for probit models with endogenous regressors. This is a two-stage procedure, in which the observed dependent variable y_j and the endogenous variables are first all regressed on the exogenous variables and the instruments. Amemiya's insight is that, provided that the model is over- identified, the structural parameters in Equation (5) can be retrieved from a GLS regression of the reduced form parameters of the first-stage regression involving the dependent variable on the reduced-form parameters from the remaining first-stage regressions. As shown by Newey (1987), this method is asymptotically equivalent to a minimum chi-squared estimator and is the most efficient method to extract structural from reduced-form parameter estimates. Finally, Lee (1991) provides a test of overidentifying restrictions for this model.

Results

The results of this instrumental variables probit specification are presented in Tables 7 and 8 for the full sample and the financially-developed subsample, respectively. Each table reports the results of 15 probit regressions (three measures of policy times five measures of fundamentals), with a dummy variable taking on the value one if the attack fails as the dependent variable. For each regression, I report the estimated coefficients, their standard errors, and the corresponding marginal effect of an increase in the right-hand side variable on the probability that a speculative attack fails. In order to assess the validity of the instruments, I report the p-value associated with the test of overidentifying restrictions (which tests the null hypothesis that the instruments affect the outcome of the attack only through their effects on policy) and the p-value associated with a test of the null hypothesis that the instruments are jointly significant in the first-stage regression of the policy variable on the instruments.

The results in Tables 7 and 8 provide very little evidence of the efficacy of tight monetary policy as a defense against speculative attacks. In all but two regressions, the coefficient on the policy variable is not statistically significantly different from zero, and the estimated marginal effects are generally tiny. The only exception is when policy is measured as the change in bank reserves, and the fundamentals are proxied by the presence of banking crises or indebtedness to the IMF. For these two cases, the estimated effect of policy is negative -- a tightening of monetary policy lowers the probability that a speculative attack fails. However, this evidence in favour of "perverse" effects of tighter monetary policy should not be taken too seriously, given the large number of other specifications which do not corroborate this finding.

An important caveat regarding Tables 7 and 8 concerns the validity of the instruments. Although in all cases the instruments comfortably pass tests of overidentifying restrictions, in many cases they have rather weak explanatory power for policy. This implies that the estimates are likely to be biased towards the probability limits of their uninstrumented counterparts, and hence may still be tainted by endogeneity bias. While this is unfortunate, it is not clear a priori whether this will result in a systematic overstatement or understatement of the effects of monetary policy, given the previous discussion that the direction of the endogeneity bias is theoretically ambiguous.

5. Conclusions

Do high interest rates help to defend exchange rates that come under speculative attack? The evidence considered in this paper suggests that the answer is no. Although proponents of the view that high interest rates can support a currency under attack can point to episodes such as Sweden in the summer of 1992, while proponents of the contrarian view that high interest rates weaken currencies can point to Korea in the fall of 1997 as supportive anecdotes, a systematic examination of interest rates around a large number of historical speculative attack episodes indicates a striking lack of evidence that the stance of monetary policy is correlated with the outcome of speculative attacks. In particular, I find no evidence that interest rates systematically increase or decrease during failed speculative attacks, nor that raising interest rates lowers or raises the probability that a speculative attack fails. This basic finding is robust to alternative measures of the stance of monetary policy, to interactions which control for differences in fundamentals across speculative attack episodes, and to controlling for the endogeneity of the policy response to a speculative attack.

Nevertheless, several shortcomings of this paper suggest that it may be premature to conclude that monetary policy is entirely ineffective in during speculative attacks. In the interests of covering a sample of speculative attacks large enough to include interesting variation in the outcome of speculative attacks, the policy response to the speculative attack, and the fundamentals that are likely to determine both the outcome of the attack and the efficacy of the policy response, I have made several compromises with regards to data and methodology. Three such compromises, and possible strategies to avoid them in future research, deserve mention.

First, I have relied on readily-available but relatively low-frequency monthly data to identify speculative attacks and the response of policy. This is unfortunate given that much of the economically interesting variation during speculative attack episodes is likely to occur at much higher daily, or even hourly, frequencies. The use of monthly data also precludes modeling the likely path-dependence in the effects of interest rates on speculative pressures, a point emphasized by Drazen (1999). Moving to high-frequency data for the more limited sample of speculative attacks for which such data is available may uncover evidence of the effects of monetary policy that are obscured by the low frequency and absence of dynamics in the present paper.

Second, in this paper I have relied on the very crude indicators of monetary policy that can readily be constructed from available monthly data. However, as noted earlier, monetary authorities have a wide variety of instruments at their disposal, including open market operations, direct interventions in foreign exchange markets, imposition of credit ceilings, etc. Disentangling these interventions from the observed fluctuations in observable high-frequency data, and modeling the choice between instruments over time and across episodes, is essential to obtaining a better understanding of the role of monetary policy during speculative attacks.

Third, in this paper I have relied on what turn out to be rather weak instruments to extract the exogenous component monetary policy. While it is theoretically unclear how this will systematically bias the results -- given that the direction of the endogeneity bias is ambiguous -- it is nevertheless unsatisfying if one is interested in understanding the effects of monetary policy during speculative attacks. One possibility for progress on this front is that by switching to higher frequency data, the more pronounced informational asymmetries between speculators and the monetary authority will result in more robust instruments. Another is to carefully investigate the institutional peculiarities of the monetary authority during individual speculative attack episodes in the hopes of identifying changes in these institutions which might serve as valid instruments.

Implementing these improvements for a sufficiently large set of speculative attack episodes that span the relevant range of country experiences will take time. Until then, however, it seems that the burden of proof for both the conventional wisdom that raising interest rates strengthens currencies under speculative attack, and also the contrarian view that it weakens them, lies with the proponents of these views.

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Appendix: Data Sources

The monthly data employed in this paper are drawn from the International Financial Statistics of the International Monetary Fund, as follows:

- Nominal exchange, local currency units per US dollar, period average (IFS Line rf).
- Non-gold reserves, US dollars (IFS Line 1l.d)
- Money market rate, percent (IFS Line 60b)
- Discount rate, percent per year, end of period (IFS Line 60). For France, Singapore Sweden and the Netherlands after December 1993, I use repurchase rates (IFS Line 60a)
- Domestic credit, local currency units (IFS Line 32)
- Reserves of deposit money banks, local currency units (IFS Line 20)
- Consumer price index (IFS Line 64). For Australia and Ireland, I use the wholesale price index (IFS Line 63)
- Imports, c.i.f., US dollars (IFS Line 71)
- Total IMF credits and loans outstanding (IFS Line 2tl)
- IMF quota (IFS Line 2t)

Lower-frequency data corresponding to the speculative attack episodes are drawn from various sources.

- Domestic credit to the private sector as a share of GDP is drawn from the World Bank World Tables (FS.AST.PRVT.GD.ZS)
- The black market premium is drawn from Easterly and Levine (1997)
- Annual real GDP growth is constant price local currency GDP figures drawn from the World Bank World Tables (NY.GDP.MKTP.KN)
- Data on banking crises are based on the IMF's May 1998 edition of the World Economic Outlook, and augmented using the original sources in Caprio and Klingebiel (1997) and Demirguc-Kunt and Detragiache (1997).

The sample of countries consists of all countries with per capita GNP greater than $800 in 1995 at Atlas exchange rates and with populations greater than one million, i.e. the

World Bank's definition of middle- and upper-income countries in that year. From this sample, I drop Chile, Algeria, Panama, Romania, Saudi Arabia, El Salvador and Turkmenistan because requisite data on discount rates was not available.

The daily data in Figure 1 are drawn from Bloomberg: SEK -- Swedish krona/US dollar, spot, mid-rate, SWBRMRGN -- marginal lending rate, mid-rate, KRW, won/US dollar, spot, mid-rate, and KWCR1T, overnight call rate, mid-rate.

Table 1: Successful and Failed Speculative Attacks

Successful Attacks				Failed Attacks							
				Large Reserve Losses						Large Spreads	
ISR	62:2	BWA	84:7	BOL	62:1*	PER	75:5	PHL	87:9*	DEU	73:3*
COL	65:9*	PRY	84:3	DEU	62:1*	PRT	75:10	TTO	87:1	ESP	74:5*
ARG	66:11*	THA	84:11*	GTM	62:6	DNK	76:7*	ZAF	87:11	MYS	74:6*
ESP	67:11*	VEN	84:2	PER	62:7*	DOM	76:1	GAB	88:5*	DNK	76:4*
FIN	67:10*	ZAF	84:7*	COL	64:7*	FRA	76:4*	GRC	88:3	ESP	76:7*
GBR	67:12*	AUS	85:2*	MAR	64:6	GBR	76:4*	GTM	88:7	ITA	76:3*
IRL	67:12*	DOM	85:1	SYR	64:8	JAM	76:5	KWT	88:7	NLD	76:8*
ISR	67:11*	ECU	85:12	CHE	65:1*	MAR	76:4*	BOL	89:12*	GBR	78:1*
JAM	67:12*	TTO	85:12	GBR	65:1*	SWE	76:10*	DOM	89:7	NLD	78:10*
MUS	67:12	GTM	86:6	GTM	65:5*	SYR	76:3*	MAR	89:3*	CAN	79:1*
PER	67:9*	IDN	86:9	DOM	66:6	TUR	76:10*	GRC	90:3*	DNK	79:9*
TTO	67:12	PRY	86:12	CHE	67:1*	ZAF	76:2*	MEX	90:3	ARG	80:10*
FRA	69:8*	VEN	86:12	COL	67:1	CHE	77:1*	FIN	91:5*	CAN	80:4*
ARG	70:6*	DOM	87:6*	ESP	67:3*	DNK	77:12*	JOR	91:8*	BEL	81:4*
ECU	70:8	PER	87:11	SYR	67:12	GAB	77:1*	TUN	91:4*	MYS	81:10*
PHL	70:3	SYR	88:1	CHE	68:7*	MUS	77:8*	ZAF	91:12*	NOR	81:12*
TUR	70:8*	GTM	89:11*	CRI	68:11	NOR	77:11*	CAN	92:11*	ESP	82:5*
ISR	71:8	ISR	89:1	DNK	68:10*	CAN	78:2*	DEU	92:10*	ESP	84:2*
KOR	71:7	PRY	89:3	ECU	68:3	CRI	78:10*	ESP	92:9*	MYS	84:10*
URY	71:12	VEN	89:3	FRA	68:6*	MUS	78:11	GAB	92:9*	MEX	85:3
BOL	72:11	DOM	90:4	GAB	68:2	ZAF	78:12*	IRL	92:9*	TUR	86:7*
JAM	73:1*	HUN	91:1	PHL	68:11	CAN	79:5*	NAM	92:4	TUR	89:11*
AUS	74:10*	POL	91:6	TTO	68:11	DOM	79:7	TTO	92:1	IDN	90:12*
ISR	74:11	TUR	91:3*	DEU	69:1*	GAB	79:3	BOL	93:1*	PRT	90:10*
KOR	74:12*	BWA	92:7	FIN	69:5*	JAM	79:8	DNK	93:1*	POL	91:2*
ARG	75:1	ECU	92:9*	URY	69:10*	SYR	79:8*	FRA	93:11*	ARG	92:7
PER	75:10	FIN	92:9*	CRI	70:7*	URY	79:3*	BOL	94:2*	KWT	92:11
ZAF	75:10*	GBR	92:10*	DOM	70:5	BOL	80:4*	DOM	94:8	NOR	92:9*
AUS	76:12*	LBN	92:3	ECU	70:1	DNK	80:2*	MEX	94:4*	PRT	92:9*
MEX	76:9*	SWE	92:11*	ITA	70:7*	PER	80:1*	SVK	94:7	POL	93:6
ESP	77:7*	TTO	93:4	SYR	70:12	PRT	80:2*	TTO	94:5*	URY	93:6
ISR	77:11*	GAB	94:1*	TWN	70:7	AUS	81:9*	ZAF	94:3*	ARG	94:12
PER	77:11	MEX	94:12*	ARG	71:10	CAN	81:7*	ARG	95:3	LVA	94:5
PRT	77:3*	VEN	95:12*	DNK	71:4*	GTM	81:6	GAB	95:2*	MAR	94:1*
IDN	78:11*	BGR	96:5	ECU	71:9	MEX	81:6*	ZAF	95:4*	POL	94:9
JAM	78:5	GTM	97:1*	IDN	71:12*	MUS	81:3*	BGR	96:1	COL	95:4*
TUR	78:3	IDN	97:8*	KOR	71:12	MAR	82:6*	GRC	96:5*	THA	95:1*
BOL	79:12*	KOR	97:11*	LBN	71:2*	MUS	82:6	NAM	96:9	DOM	96:6
MUS	79:11*	MKD	97:7	MAR	71:10*	PHL	82:1*	SWE	96:11*	LVA	96:2
TUR	79:6	PHL	97:9*	CRI	72:2	URY	82:1*	FIN	97:11*	RUS	96:9
KOR	80:1	THA	97:7*	GBR	72:7*	GAB	83:11*	IRL	97:4*	URY	96:9
ARG	81:2*	BWA	98:7	GAB	73:6*	CAN	84:6*	NOR	97:12*	BRA	97:11
CRI	81:1*	MDA	98:10	SYR	73:2	DNK	84:12*	RUS	97:11	EST	97:11
MUS	81:10*	MEX	98:9*	ZAF	73:11*	COL	85:1	BRA	98:9	POL	97:9
BOL	82:2	NAM	98:7	DOM	74:1	JOR	85:3*	CAN	98:8*	UKR	97:12
ECU	82:5	RUS	98:9	ITA	74:2*	PHL	85:10*			HKG	98:8*
FIN	82:10*	UKR	98:9	JAM	74:5*	CAN	86:3*			URY	98:9
MEX	82:2*	ZAF	98:7*	KOR	74:7*	DOM	86:5*				
PRT	82:6	BRA	99:1	MUS	74:5	FIN	86:8*				
SWE	82:10*	KAZ	99:4	URY	74:4*	JAM	86:10				
URY	82:12*			AUS	75:12*	KOR	86:1*				
GRC	83:1			BOL	75:9*	BOL	87:3				
IDN	83:4*			CRI	75:10*	CAN	87:4*				
JAM	83:11*			GAB	75:1*	GAB	87:1*				
PHL	83:10			IDN	75:3*	KOR	87:12				
				ITA	75:7*						

Note: * indicates attacks in the financially-developed subsample.

Table 2: Selected Speculative Attack Episodes

	Country	Date	Classification of Attack	% Growth in: Exchange Rate	Reserves
Asia 1997					
	Indonesia	97:8	Succeed	11.2%	-4.7%
	Korea	97:11	Succeed	11.3%	-19.6%
	Malaysia 1/	97:8	n/a	6.6%	1.4%
	Philippines	97:7	Succeed	10.4%	6.1%
	Thailand	97:7	Succeed	17.6%	-6.1%
Europe 1992-93					
	Belgium 2/	92:11	n/a	7.2%	-14.3%
	Denmark 3/	93:1	Fail	1.9%	-28.6%
	France 4/	93:11	Fail	2.8%	-22.7%
	Ireland 5/	92:09	Fail	0.3%	-3.8%
	Italy 6/	92:10	n/a	11.6%	7.7%
	United Kingdom 7/	92:10	Succeed	11.6%	-4.4%
	Spain 8/	92:09	Fail	4.5%	-20.0%
	Sweden	92:11	Succeed	11.5%	-24.6%
	Finland	92:11	Succeed	11.6%	1.9%

1/ Nominal devaluation too small to qualify as successful attack.
2/ Nominal devaluation too small to qualify as successful attack. ERW date is 92:9.
3/ ERW date is 92:9.
4/ ERW date is 92:9.
5/ ERW date is 92:11.
6/ ERW date is 92:9. Exchange rate too volatile prior to attack to qualify as successful attack.
7/ ERW date is 92:8.
8/ Subsequent devaluation of peseta in 92:10 too small to prevent classification as failed attack.

ERW: Eichengreen,Rose and Wyplosz (1994).

Table 3: Changes In Monetary Policy During Speculative Attacks (Full Sample)

Discount Rates

	Speculative Attack: Succeeds	Fails	Total
Monetary Policy			
Tightens	37	95	132
Eases	40	72	112
Total	77	167	244

	Estimate	95% Confidence Interval	
P[Tightens | Fails]	0.57	0.49	0.65
P[Fails | Tightens]	0.72	0.64	0.80
P-Value for Independence	0.20		

Domestic Credit Growth

	Speculative Attack: Succeeds	Fails	Total
Monetary Policy			
Tightens	41	83	124
Eases	59	101	160
Total	100	184	284

	Estimate	95% Confidence Interval	
P[Tightens | Fails]	0.45	0.38	0.52
P[Fails | Tightens]	0.67	0.58	0.75
P-Value for Independence	0.50		

Bank Reserves

	Speculative Attack: Succeeds	Fails	Total
Monetary Policy			
Tightens	39	58	97
Eases	47	119	166
Total	86	177	263

	Estimate	95% Confidence Interval	
P[Tightens | Fails]	0.33	0.26	0.40
P[Fails | Tightens]	0.60	0.50	0.70
P-Value for Independence	0.05		

Notes: The contingency tables report the distribution of speculative attacks according to a two-way classification of whether monetary policy tightened or not using the indicated measure of monetary policy, and whether the attack succeeded or failed. P[Tightens | Fails] reports the conditional probability that monetary policy tightens during failed attacks, and P[Fails | Tightens] reports the conditional probability that the attack fails during episodes where monetary policy tightens. P-Value for Independence reports the p-value associated with a chi-squared test of independence of the rows and columns of the contingency table.

Table 4: Changes In Monetary Policy During Speculative Attacks (Financially-Developed Sample)

Discount Rates

	Speculative Attack: Succeeds	Fails	Total
Monetary Policy			
Tightens	13	47	60
Eases	15	40	55
Total	28	87	115

	Estimate	95% Confidence Interval	
P[Tightens | Fails]	0.54	0.43	0.65
P[Fails | Tightens]	0.78	0.68	0.89
P-Value for Independence	0.48		

Domestic Credit Growth

	Speculative Attack: Succeeds	Fails	Total
Monetary Policy			
Tightens	14	35	49
Eases	22	49	71
Total	36	84	120

	Estimate	95% Confidence Interval	
P[Tightens | Fails]	0.42	0.31	0.52
P[Fails | Tightens]	0.71	0.59	0.84
P-Value for Independence	0.78		

Bank Reserves

	Speculative Attack: Succeeds	Fails	Total
Monetary Policy			
Tightens	17	29	46
Eases	18	53	71
Total	35	82	117

	Estimate	95% Confidence Interval	
P[Tightens | Fails]	0.35	0.25	0.46
P[Fails | Tightens]	0.63	0.49	0.77
P-Value for Independence	0.18		

Notes: The contingency tables report the distribution of speculative attacks according to a two-way classification of whether monetary policy tightened or not using the indicated measure of monetary policy, and whether the attack succeeded or failed. P[Tightens | Fails] reports the conditional probability that monetary policy tightens during failed attacks, and P[Fails | Tightens] reports the conditional probability that the attack fails during episodes where monetary policy tightens. P-Value for Independence reports the p-value associated with a chi-squared test of independence of the rows and columns of the contingency table.

Table 5: Weaker Tests of Necessity and Sufficiency (Full Sample)

	Failed Attacks	Successful Attacks	P-Value	Marginal Effect	t-Statistic	Number of Observations
Increase in Real Discount Rate						
Full Sample	1.342	-3.111	0.085	0.003	1.752	239
OECD	1.173	-8.492	0.040	0.006	2.163	88
1980s and 1990s	-1.378	-2.847	0.644	0.001	0.471	136
No Banking Crises	1.655	-3.127	0.123	0.003	1.601	188
No Real Overvaluation	1.652	-1.279	0.437	0.002	0.861	113
High Reserves	1.067	-4.784	0.123	0.003	1.509	124
Low Quota Drawings	1.411	1.021	0.892	0.000	0.119	112
High Point in Cycle	0.391	-2.443	0.526	0.001	0.677	116
Decrease in Real Domestic Credit Growth						
Full Sample	-3.657	0.404	0.482	-0.001	-0.717	230
OECD	-1.779	13.801	0.056	-0.002	-1.623	75
1980s and 1990s	-2.043	-4.608	0.734	0.000	0.348	131
No Banking Crises	-4.032	4.096	0.204	-0.001	-1.298	184
No Real Overvaluation	0.499	7.143	0.452	-0.001	-0.790	109
High Reserves	-1.515	1.907	0.677	0.000	-0.437	123
Low Quota Drawings	1.628	-3.868	0.501	0.001	0.674	100
High Point in Cycle	-6.527	1.848	0.316	-0.001	-1.001	125
Increase in Bank Reserves						
Full Sample	-0.522	-0.140	0.073	-0.033	-1.777	263
OECD	-0.295	0.038	0.131	-0.071	-1.147	77
1980s and 1990s	-0.399	-0.200	0.450	-0.017	-0.726	154
No Banking Crises	-0.652	-0.328	0.128	-0.033	-1.445	204
No Real Overvaluation	-0.536	0.031	0.017	-0.052	-1.841	126
High Reserves	-0.544	-0.099	0.172	-0.033	-1.403	142
Low Quota Drawings	-0.483	-0.380	0.741	-0.009	-0.321	114
High Point in Cycle	-0.519	-0.208	0.279	-0.021	-0.950	143

Notes: The first two columns report the mean value of the indicated policy variable during failed and successful attacks, in the indicated subsample of events. The third column reports the p-value associated with a test of the null hypothesis that the means are equal in the two samples. The fourth column reports the estimated marginal effect of policy in a probit regression expressing the probability that a speculative attack fails as a function of a constant and the indicated policy variable, in the indicated subsample of events. The fifth column reports the t-statistic associated with the estimate of the underlying slope coefficient. The final column indicates the number of observations for which the policy variables are available in the indicated subsample of events.

Table 6: Weaker Tests of Necessity and Sufficiency (Financially-Developed Sample)

	Failed Attacks	Successful Attacks	P-Value	Marginal Effect	t-Statistic	Number of Observations
Increase in Real Discount Rate						
Full Sample	-0.155	-4.464	0.177	0.004	1.409	115
OECD	0.725	-11.236	0.016	0.008	2.540	71
1980s and 1990s	-1.671	-0.972	0.836	-0.001	-0.214	65
No Banking Crises	1.181	-4.713	0.127	0.005	1.535	84
No Real Overvaluation	1.728	-1.163	0.555	0.003	0.640	56
High Reserves	-0.267	-4.331	0.260	0.004	1.130	71
Low Quota Drawings	0.785	-1.590	0.556	0.002	0.515	66
High Point in Cycle	-0.664	-6.405	0.242	0.005	1.258	57
Decrease in Real Domestic Credit Growth						
Full Sample	-7.339	-3.195	0.561	-0.001	-0.542	108
OECD	-5.725	6.347	0.103	-0.002	-1.191	63
1980s and 1990s	-8.812	-4.203	0.635	-0.001	-0.438	61
No Banking Crises	-6.166	3.530	0.233	-0.001	-1.083	83
No Real Overvaluation	1.780	-2.841	0.635	0.001	0.458	54
High Reserves	-7.870	-0.305	0.457	-0.001	-0.751	67
Low Quota Drawings	-3.078	-1.327	0.806	0.000	-0.170	62
High Point in Cycle	-11.119	0.831	0.280	-0.001	-0.986	55
Increase in Bank Reserves						
Full Sample	-0.247	0.280	0.117	-0.050	-1.654	117
OECD	-0.340	-0.081	0.246	-0.046	-0.757	64
1980s and 1990s	-0.099	0.220	0.339	-0.033	-0.837	68
No Banking Crises	-0.380	-0.066	0.149	-0.065	-1.161	87
No Real Overvaluation	-0.246	0.017	0.255	-0.064	-0.808	57
High Reserves	-0.454	0.304	0.141	-0.064	-1.512	65
Low Quota Drawings	-0.391	0.056	0.273	-0.052	-1.107	65
High Point in Cycle	-0.071	0.350	0.224	-0.040	-0.994	61

Notes: The first two columns report the mean value of the indicated policy variable during failed and successful attacks, in the indicated subsample of events. The third column reports the p-value associated with a test of the null hypothesis that the means are equal in the two samples. The fourth column reports the estimated marginal effect of policy in a probit regression expressing the probability that a speculative attack fails as a function of a constant and the indicated policy variable, in the indicated subsample of events. The fifth column reports the t-statistic associated with the estimate of the underlying slope coefficient. The final column indicates the number of observations for which the policy variables are available in the indicated subsample of events.

Table 7: Controlling for the Endogeneity of Policy (Full Sample)

		Fundamental (f): Banking Crisis	Real Overvaluation	Reserves/ Imports	IMF Borrowing	Growth Deviation
		Increase in Real Discount Rate				
i	β	0.015	0.009	-0.142	0.037	-0.052
	se(β)	0.152	0.462	0.188	0.129	0.220
	dP[Fail]/dβ	0.005	0.003	-0.017	0.012	-0.012
ixf	β	-0.070	0.000	0.090	0.000	0.013
	se(β)	0.244	0.040	0.095	0.001	0.031
	dP[Fail]/dβ	-0.024	0.000	0.011	0.000	0.003
f	β	-0.221	0.011	-0.192	-0.002	-0.061
	se(β)	1.955	0.265	0.295	0.004	0.308
	dP[Fail]/dβ	-0.074	0.004	-0.023	-0.001	-0.014
p-OID		0.830	0.985	0.628	0.702	0.918
p-FSR		0.031	0.134	0.102	0.015	0.145
Number of Observations		202	199	191	202	180
		Decrease in Real Domestic Credit Growth				
i	β	-0.105	-0.093	0.118	-0.065	0.001
	se(β)	0.134	0.110	0.226	0.084	0.081
	dP[Fail]/dβ	-0.011	-0.008	0.011	-0.011	0.000
ixf	β	0.137	-0.007	-0.038	0.000	-0.002
	se(β)	0.162	0.009	0.052	0.000	0.017
	dP[Fail]/dβ	0.014	-0.001	-0.004	0.000	-0.001
f	β	0.652	0.019	0.215	-0.002	0.051
	se(β)	1.538	0.055	0.432	0.003	0.187
	dP[Fail]/dβ	0.066	0.002	0.021	0.000	0.017
p-OID		0.716	0.848	0.759	0.559	0.915
p-FSR		0.329	0.762	0.477	0.682	0.075
Number of Observations		200	197	191	199	182
		Increase in Bank Reserves				
i	β	-1.339**	-2.266	-4.834	-2.122*	-1.298
	se(β)	0.574	5.489	3.419	1.191	1.725
	dP[Fail]/dβ	-0.254	-0.229	-0.506	-0.263	-0.213
ixf	β	2.465	-0.065	0.850	0.004	-0.083
	se(β)	1.919	0.245	0.764	0.006	0.129
	dP[Fail]/dβ	0.467	-0.007	0.089	0.001	-0.014
f	β	1.345	-0.029	0.451	0.004	-0.022
	se(β)	0.841	0.168	0.496	0.003	0.160
	dP[Fail]/dβ	0.255	-0.003	0.047	0.000	-0.004
p-OID		0.957	0.952	0.833	0.736	0.730
p-FSR		0.051	0.155	0.633	0.357	0.087
Number of Observations		229	226	218	228	215

Notes: This table reports the results of a probit regression which expresses the probability that a speculative attack fails as a function of the monetary policy response (i), a fundamental (f), and the interaction between the two (ixf), for the indicated measures of policies and fundamentals. All regressions also include a constant. The rows labelled β, se(β), and dP[Fail]/dβ report the estimated coefficient, its standard error, and the estimated marginal effect. The policy variable and its interaction with the fundamental are treated as endogenous, and are instrumented using the contemporaneous change in reserves and the change in IMF lending, and their interactions with fundamentals. The model is estimated using Amemiya's two-stage GLS procedure for instrumental variables probit models. p-OID reports the p-value for the test of overidentifying restrictions, and p-FSR reports the p-value for the null hypothesis that the instruments are jointly insignificant in the first-stage regression of the policy variable on the instruments. * (**) denotes significance at the 10% (5%) level.

Table 8: Controlling for the Endogeneity of Policy (Financially-Developed Sample)

		Banking Crisis	Real Overvaluation	Reserves/ Imports	IMF Borrowing	Growth Deviation
		Fundamental (f):				
		Increase in Real Discount Rate				
i	β	-0.039	0.105	-0.004	0.333	-0.005
	se(β)	6.700	0.167	0.381	0.395	0.796
	dP[Fail]/dβ	-0.010	0.020	-0.001	0.032	-0.001
ixf	β	-0.053	-0.009	0.022	-0.001	0.001
	se(β)	9.661	0.010	0.081	0.002	0.097
	dP[Fail]/dβ	-0.013	-0.002	0.006	0.000	0.000
f	β	-0.907	-0.029	0.024	0.000	0.034
	se(β)	28.351	0.069	0.378	0.008	0.757
	dP[Fail]/dβ	-0.222	-0.006	0.007	0.000	0.010
p-OID		0.993	0.779	0.915	0.886	0.961
p-FSR		0.366	0.091	0.386	0.479	0.228
Number of Observations		105	104	104	105	104
		Decrease in Real Domestic Credit Growth				
i	β	0.007	-0.044	-0.010	-0.979	0.055
	se(β)	0.628	0.062	0.114	12.762	3.053
	dP[Fail]/dβ	0.002	-0.008	-0.003	-0.013	0.008
ixf	β	0.010	0.004	0.004	0.004	-0.011
	se(β)	1.114	0.006	0.025	0.046	0.605
	dP[Fail]/dβ	0.003	0.001	0.001	0.000	-0.002
f	β	-0.217	0.018	0.060	-0.006	-0.106
	se(β)	8.346	0.060	0.379	0.078	7.385
	dP[Fail]/dβ	-0.067	0.003	0.019	0.000	-0.016
p-OID		0.957	0.705	0.716	1.000	0.999
p-FSR		0.306	0.591	0.466	0.259	0.228
Number of Observations		98	97	98	98	96
		Increase in Bank Reserves				
i	β	-2.946	-2.590	-2.811	-0.864	-6.951
	se(β)	1.824	9.620	2.661	12.202	162.283
	dP[Fail]/dβ	-0.320	-0.261	-0.648	-0.193	-0.251
ixf	β	2.080	0.116	0.674	-0.001	-0.681
	se(β)	5.179	0.921	0.861	0.055	15.232
	dP[Fail]/dβ	0.226	0.012	0.155	0.000	-0.025
f	β	1.834	0.018	0.163	0.002	-0.042
	se(β)	1.847	0.420	0.286	0.062	2.365
	dP[Fail]/dβ	0.199	0.002	0.038	0.000	-0.002
p-OID		0.712	0.903	0.649	0.956	0.996
p-FSR		0.620	0.965	0.612	0.347	0.897
Number of Observations		105	104	104	105	105

Notes: This table reports the results of a probit regression which expresses the probability that a speculative attack fails as a function of the monetary policy response (i), a fundamental (f), and the interaction between the two (ixf), for the indicated measures of policies and fundamentals. All regressions also include a constant. The rows labelled β, se(β), and dP[Fail]/dβ report the estimated coefficient, its standard error, and the estimated marginal effect. The policy variable and its interaction with the fundamental are treated as endogenous, and are instrumented using the contemporaneous change in reserves and the change in IMF lending, and their interactions with fundamentals. The model is estimated using Amemiya's two-stage GLS procedure for instrumental variables probit models. p-OID reports the p-value for the test of overidentifying restrictions, and p-FSR reports the p-value for the null hypothesis that the instruments are jointly insignificant in the first-stage regression of the policy variable on the instruments. . * (**) denotes significance at the 10% (5%) level.

Figure 1: What Do High Interest Rates Do?

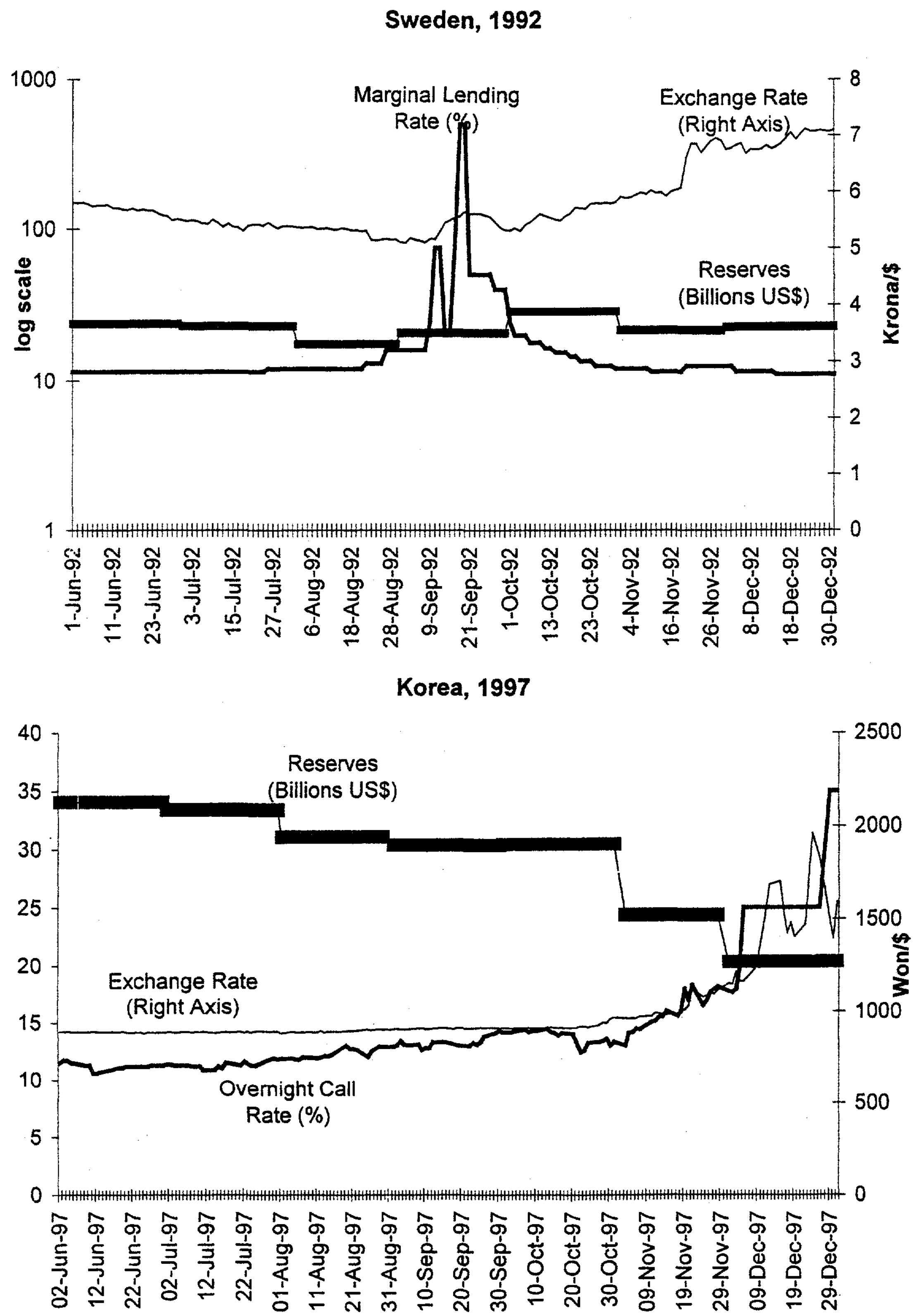
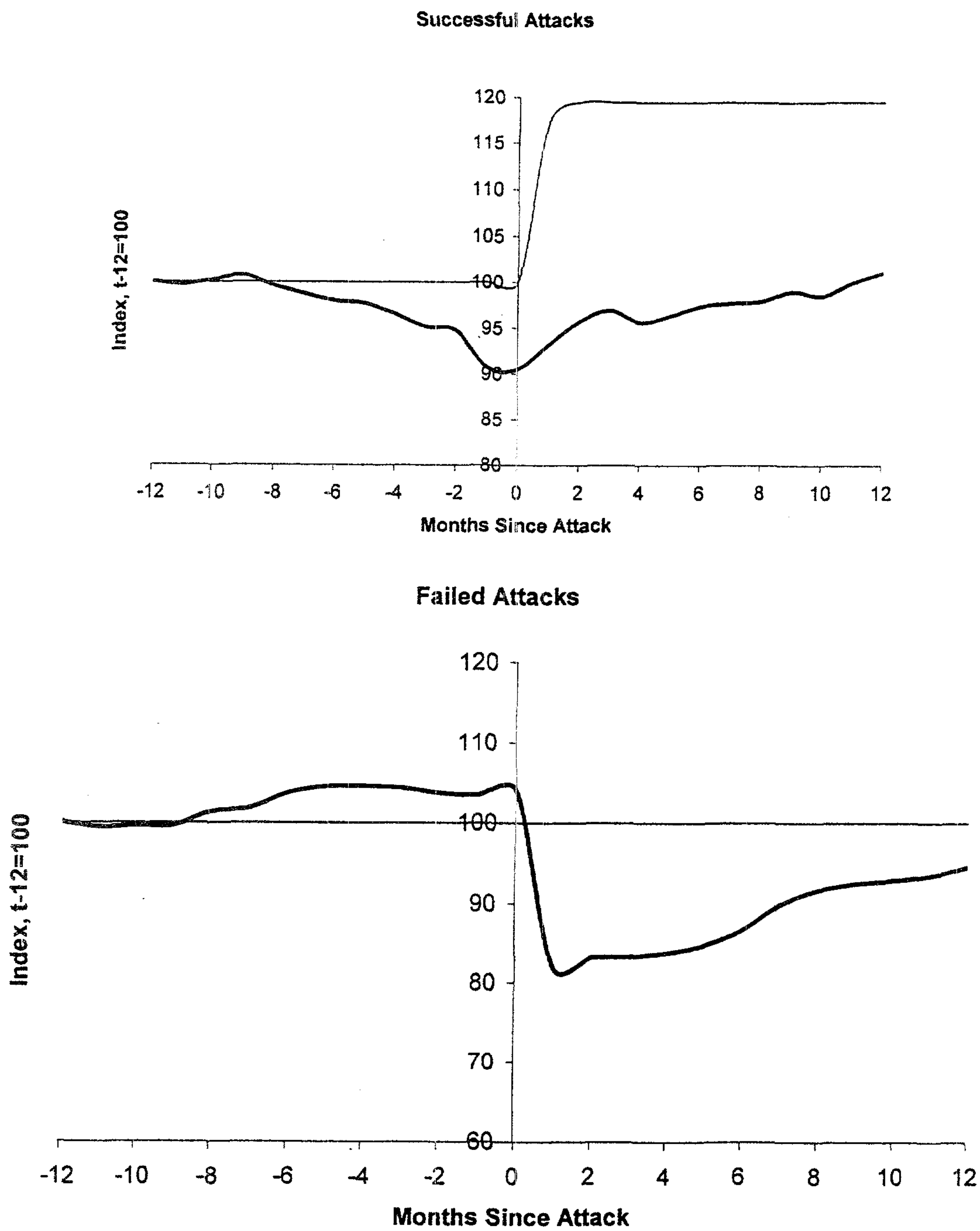
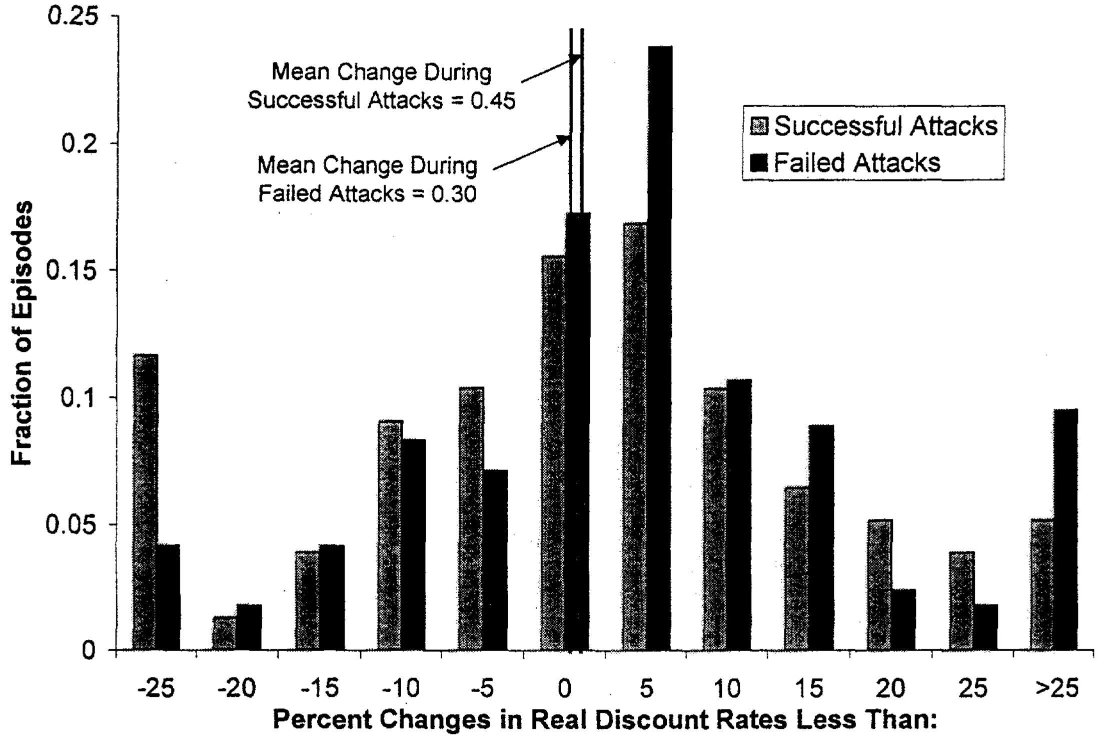


Figure 2: Exchange Rates and Reserves During Successful and Failed Speculative Attacks



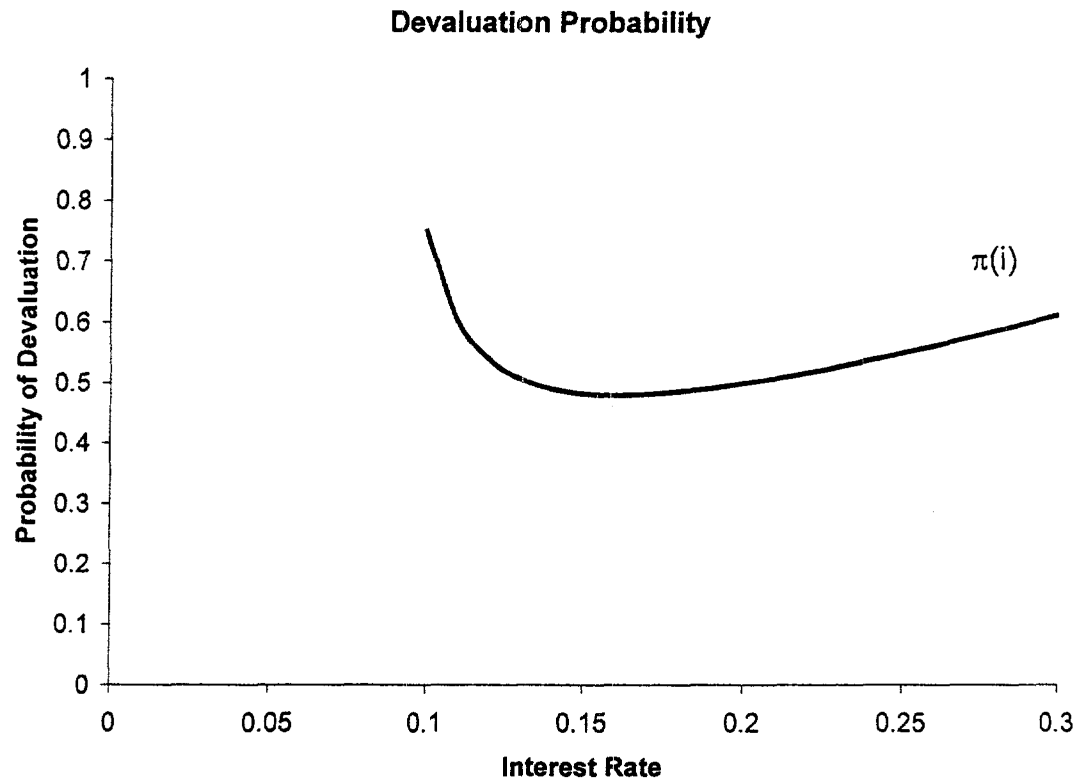
Notes: This figure shows the evolution of the median nominal exchange rate and reserves during successful and failed speculative attacks. The figures are constructed by cumulating the median (across all episodes) growth rate of the indicated variables to a base of 100 twelve months prior to the attack.

Figure 3: Changes in Real Discount Rates During Successful and Failed Speculative Attacks



Notes: This figure shows the frequency distribution of percentage changes in real discount rates during successful and failed speculative attacks. The mean changes during successful and failed attacks are based on changes in real discount rates less than 25% in absolute value.

Figure 4: Devaluation Probabilities as a Function of Interest Rates



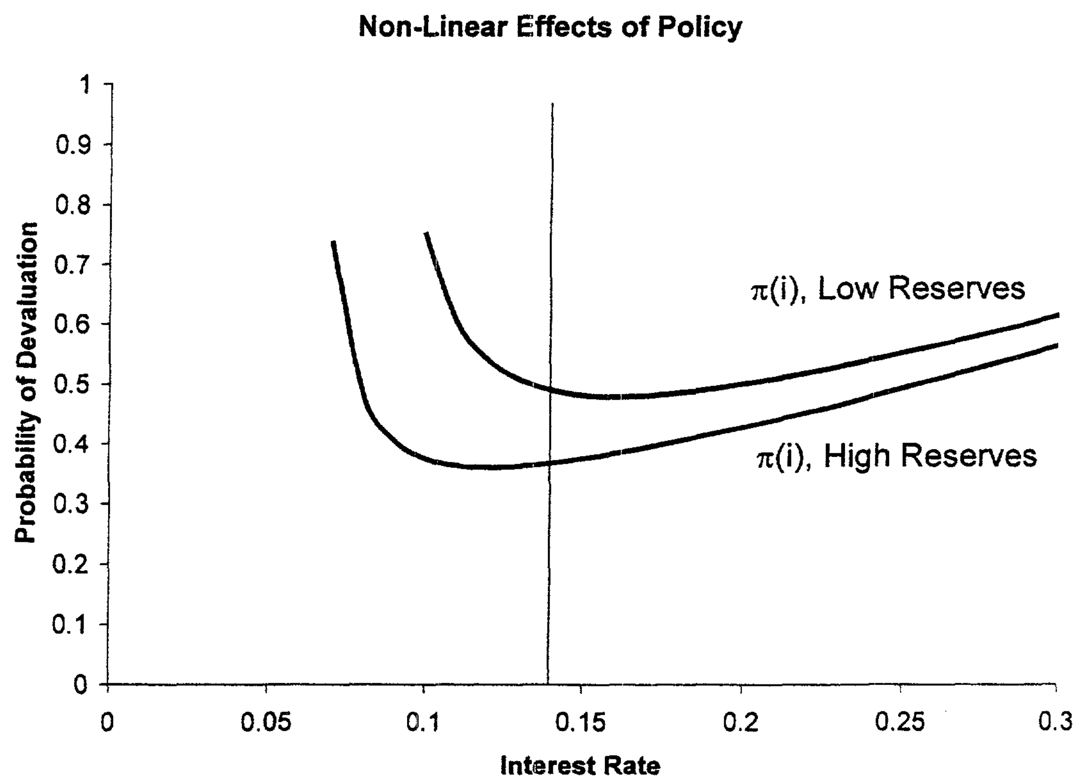
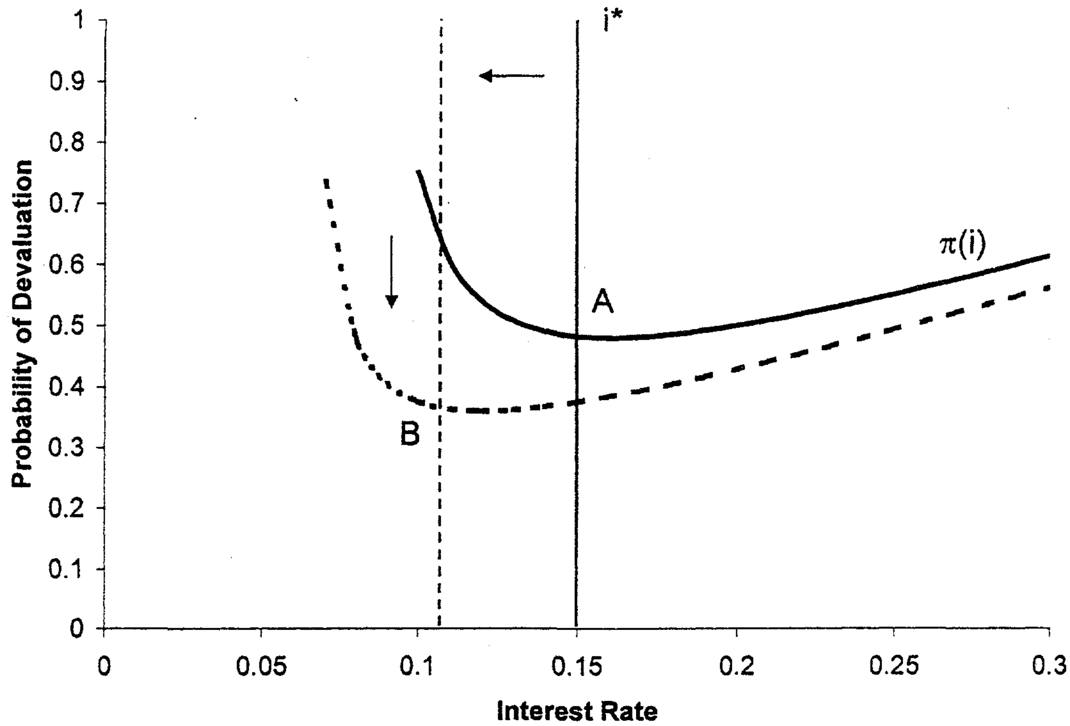
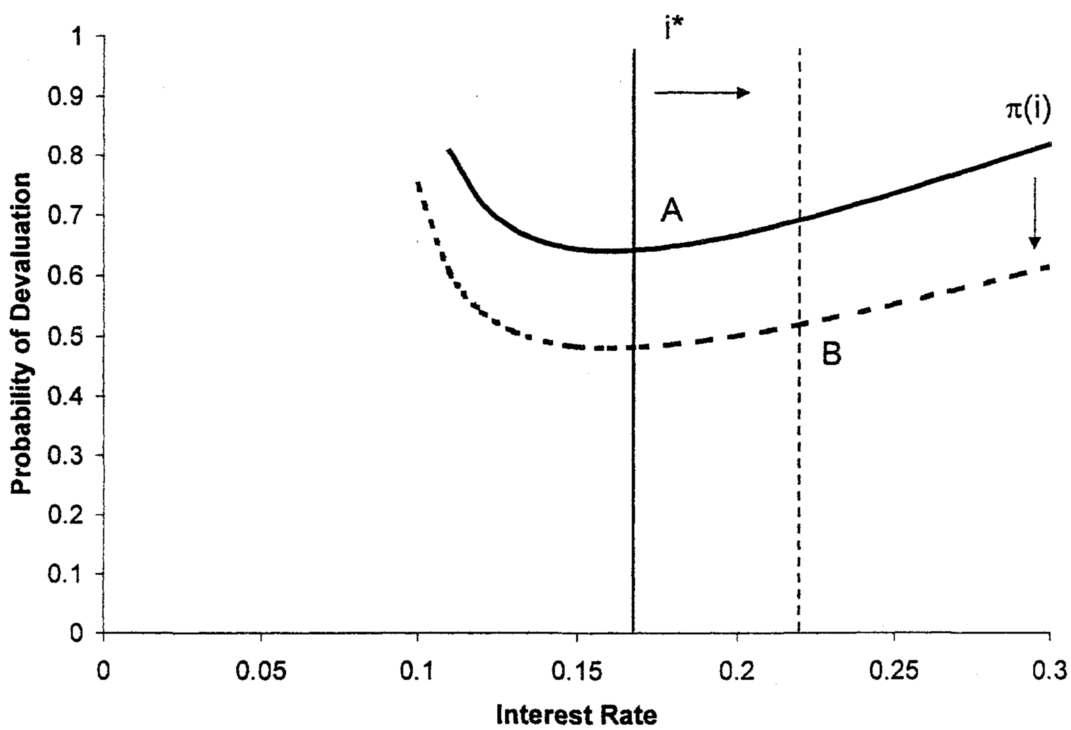


Figure 5: The Endogeneity of Policy

Case 1: Endogeneity Bias Obscures Conventional View



Case 2: Endogeneity Bias Exaggerates Conventional View



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